## C L A I M S

1. A surface shape recognizing sensor device characterized by comprising:

a plurality of sensor cells which are two-dimensionally arranged, detect capacitances corresponding to ridges and valleys of a surface of an object to be recognized, and output signals corresponding to the capacitances; and

a signal processor which calculates a surface shape of the object on the basis of the signals input from said sensor cells,

said sensor cell comprising:

a substrate;

a first electrode formed on said substrate;

a signal output unit which outputs a signal corresponding to a capacitance formed between said first electrode and the surface of the object;

a second electrode formed on said substrate so as to be insulated and isolated from said first electrode; and

a potential controller which controls a potential of the surface of the object via a capacitance formed between said second electrode and the surface of the object by controlling a potential of said second electrode.

2. A surface shape recognizing sensor device according to claim 1, characterized in that said signal

output unit comprises:

a signal generating circuit which generates a voltage signal corresponding to the capacitance formed between said first electrode and the surface of the object;

a charging/discharging circuit which performs one of storage and removal of an electric charge with respect to a node as a connecting point between said first electrode and an output of said signal generating circuit, before the signal is generated by said signal generating circuit; and

a detection circuit which detects the voltage signal output from said signal generating circuit to the node after one of the storage and removal of an electric charge is performed, and outputs the voltage signal as an output from said signal output unit.

3. A surface shape recognizing sensor device according to claim 2, characterized in that said potential controller comprises a potential control circuit which changes the potential of said second electrode in an opposite direction to a change in voltage signal output from said signal generating circuit.

4. A surface shape recognizing sensor device according to claim 1, characterized in that said signal output unit comprises:

a signal generating circuit which generates a

voltage signal corresponding to the capacitance formed between said first electrode and the surface of the object;

a charging circuit which stores an electric charge in a node as a connecting point between said first electrode and an output of said signal generating circuit, before the signal is generated by said signal generating circuit; and

a detection circuit which detects the voltage signal output from said signal generating circuit to the node after the electric charge is stored, and outputs the voltage signal as an output from said signal output unit.

5. A surface shape recognizing sensor device according to claim 4, characterized in that

said signal generating circuit comprises:

a first current source which removes the electric charge from the node; and

a first switching element which is placed between the node and said first current source, and generates a voltage signal by connecting the node and said first current source for only a predetermined period after an electric charge is stored in the node, and

said potential controller comprises:

a second current source which charges said second electrode; and

a second switching element which is placed between said second electrode and said second current source, and controls the potential of said second electrode by connecting said second electrode and said second current source.

6. A surface shape recognizing sensor device according to claim 5, characterized by further comprising a control signal output unit which outputs a control signal which controls said first switching element and said second switching element together.

7. A surface shape recognizing sensor device according to claim 4, characterized in that

said signal generating circuit comprises:

a capacitive element including a first terminal and a second terminal, the first terminal being connected to the node; and

a third switching element which sets the second terminal of said capacitive element at a first potential before charging to the node is completed, and sets the second terminal at a second potential lower than the first potential after the charging is completed, thereby generating a voltage signal from said capacitive element, and

said potential controller comprises a setting unit which sets said second electrode at a third potential before the charging to the node is completed, and sets said second electrode at a fourth potential

higher than the third potential after the charging is completed, thereby controlling the potential of said second electrode.

8. A surface shape recognizing sensor device according to claim 7, characterized by further comprising a control signal output unit which outputs a control signal which controls said third switching element and said setting unit together.

9. A surface shape recognizing sensor device according to claim 2, characterized in that said potential controller comprises a potential control circuit which changes the potential of said second electrode in an opposite direction to a potential change when one of charging and discharging of the node is performed, and to a change in voltage signal output from said signal generating circuit.

10. A surface shape recognizing sensor device according to claim 4, characterized in that

said signal generating circuit comprises:

a first current source which removes the electric charge from the node; and

a first switching element which is placed between the node and said first current source, and generates a voltage signal by connecting the node and said first current source for only a predetermined period after an electric charge is stored in the node, and

said potential control circuit comprises:

a second current source which charges said second electrode; and

a second switching element which sets said second electrode at a fifth potential before charging to the node is started, sets said second electrode at a sixth potential lower than the fifth potential when the charging is started, and then connects said second electrode and said second current source, thereby controlling the potential of said second electrode.

11. A surface shape recognizing sensor device according to claim 4, characterized in that

said signal generating circuit comprises:

a capacitive element including a first terminal and a second terminal, the first terminal being connected to the node; and

a third switching element which sets the second terminal of said capacitive element at a first potential before charging to the node is completed, and sets the second terminal at a second potential lower than the first potential after the charging is completed, thereby generating a voltage signal from said capacitive element, and

said potential control circuit comprises a setting unit which sets said second electrode at a seventh potential before the charging to the node is started, sets said second electrode at an eighth

potential lower than the seventh potential when the charging is started, and sets said second electrode at a ninth potential higher than the eighth potential after the charging is completed, thereby controlling the potential of said second electrode.

12. A surface shape recognizing sensor device according to claim 11, characterized by further comprising a control signal output unit which outputs a control signal which controls said charging circuit and said setting unit together.

13. A surface shape recognizing sensor device according to claim 1, characterized in that said second electrode is formed to surround said first electrode.

14. A surface shape recognizing sensor device according to claim 1, characterized in that said first electrode is formed to surround said second electrode.

15. A surface shape recognizing sensor device according to claim 1, characterized in that an area of said second electrode is not more than an area of said first electrode.

16. A surface shape recognizing sensor device according to claim 15, characterized in that the area of said second electrode is smaller than the area of said first electrode.

17. A surface shape recognizing sensor device according to claim 1, characterized in that said second electrode is formed at a height different from said

first electrode with respect to a surface of said substrate.